

### **REMARKS**

Claims 1-3, 5-17, 19-21, 23 and 24 are pending in this application.

#### **Rejections under 35 U.S.C § 103:**

Claims 1, 2, 5, 6, 9, 10, 12, 13, 15-17, 21 and 23 stand rejected under 35 U.S.C § 103 (a) as unpatentable over Chu (U.S. Patent Publication 2004/0192058) in view of Ma (U.S. Patent 6,830,877).

Claims 1, 9, and 15 recite, *inter alia*, treating the photoresist pattern comprising an ArF photoresist material with plasma generated by exciting a fluorine-free carbon-containing gas. Claim 12 recites, *inter alia*, forming a polymer layer comprising carbon on the surface of the photoresist pattern comprising an ArF photoresist material using plasma generated by exciting a fluorine-free carbon-containing gas. Claim 21 recites, *inter alia*, forming a polymer layer using plasma generated by exciting a fluorine-free carbon-containing gas, the polymer layer comprising carbon on the surface of the photoresist pattern comprising an ArF photoresist material. Applicants respectfully submit that neither Chu, Ma, nor any combinations thereof teaches or suggests the above-claimed features.

The Examiner acknowledges that “Chu fails to disclose that an ArF photoresist material is used.” For this element, the Examiner relies on Ma. The Examiner states that “Ma is being used to teach that an ArF light source is a type of deep ultraviolet light, which the references, Chu and Lindley, use in their processes.” See page 7 of the Office Action. Applicants respectfully disagree.

Applicants respectfully submit that Ma teaches away from using an ArF photoresist material in connection with treating a photoresist pattern by exciting a carbon-

containing gas as described in Chu. This is because in Ma the photoresist materials including the ArF photoresist material are treated by a heat process such as curing or annealing. For example, Ma states that “it is yet another object of the present invention to provide a method for forming via openings or contact holes that have improved aspect ratios by first exposing the photoresist to UV radiation for a time period of at least 1 minute at a temperature of at least 100°C.” See col. 3, lines 28-32 of Ma. It is well known in the art that the curing process applied to the ArF photoresist material taught by Ma is a different type of photoresist pretreatment compared to the plasma treatment by exciting a carbon-containing gas taught by Chu, because such a heat treatment of Ma takes longer and should be performed in separate chambers. Therefore, unlike the Examiner’s assertion, one of ordinary skill in the art would not be led to replace the photoresist material of Chu with the ArF photoresist material of Ma.

Furthermore, claims 1 and 17 are allowable for additional reasons. For example, Chu does not disclose or suggest an etching target layer formed of a material layer selected from a group consisting of a silicon oxide layer, a silicon nitride layer, a silicon oxynitride layer, and an organic anti-reflective coating layer. In contrast, Chu discloses that the etching target layer (25) includes organo silicate glass (OSG), C-oxide, and fluorinated silicate glass (FSG).

Thus, claims 1, 9, 12, 15 and 21 are not rendered obvious over Chu in view of Ma. As claims 2, 5, 6, 10, 13, 16, 17 and 23 depend from claims 1, 9, 12, 15 and 21, respectively, they are also not rendered obvious over Chu in view of Ma for at least the above reasons.

Based on the arguments above, reconsideration and withdrawal of the rejection of claims 1, 2, 5, 6, 9, 10, 12, 13, 15-17, 21 and 23 under 35 U.S.C § 103 (a) is respectfully requested.

Claims 1, 2, 5-10, 12, 13, 15-17, 19-21 and 23 stand rejected under 35 U.S.C § 103 (a) as unpatentable over Lindley (U.S. Patent 6,326,307) in view of Meyer (U.S. Patent 4,504,574) and Ma.

Claims 1, 9 and 15 recite, *inter alia*, treating the photoresist pattern comprising an ArF photoresist material with plasma generated by exciting a fluorine-free carbon-containing gas. Claim 12 recites, *inter alia*, forming a polymer layer comprising carbon on the surface of the photoresist pattern comprising an ArF photoresist material using plasma generated by exciting a fluorine-free carbon-containing gas. Claim 21 recites, *inter alia*, forming a polymer layer using plasma generated by exciting a fluorine-free carbon-containing gas, the polymer layer comprising carbon on the surface of the photoresist pattern comprising an ArF photoresist material. Applicants respectfully submit that neither Lindley, Meyer, Ma, nor any combination thereof teaches or suggests the above-claimed features.

The Examiner acknowledges that Lindley and Meyer fail to disclose the claimed features that plasma used for the the photoresist treatment is formed using a fluorine-free carbon-containing gas and that an ArF photoresist material is used, and that the carbon monoxide plasma contains fluorine. See page 5 of the Office Action. For this missing teaching, the Examiner relies on Ma.

However, as stated above, Ma teaches away from using an ArF photoresist material in connection with treating a photoresist pattern by plasma as described in

Lindley. This is because in Ma the photoresist materials including the ArF photoresist material are treated by a heat process such as curing or annealing. In contrast, Lindley describes that a heat treatment such as annealing is a different type of photoresist pretreatment from the plasma treatment performed by exciting a fluorine-free carbon-containing gas in Lindley, because such a heat treatment takes longer and should be performed in separate chambers. See e.g., col. 10, lines 2-4 of Lindley.

Thus, claims 1, 9, 12, 15 and 21 are not rendered obvious over Lindley in view of Meyer and further in view of Ma. As claims 2, 5-8, 10, 13, 16, 17, 19, 20 and 23 depend from claims 1, 9, 12, 15 and 21, respectively, they are also not rendered obvious over Lindley in view of Meyer and further in view of Ma for at least the above reasons.

Based on the arguments above, reconsideration and withdrawal of the rejection of claims 1, 2, 5-10, 12, 13, 15-17, 19-21 and 23 under 35 U.S.C § 103 (a) is respectfully requested.

Claims 3, 11, 14 and 24 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Lindley in view of Meyer and Ma and further in view of Ko (U.S. Patent Application 2003/0129816).

Claims 3, 11, 14 and 24 depend from claims 1, 9, 12 and 21, respectively. Thus, these dependent claims are also patentable for at least the same reasons given for the respective base claims.

Therefore, Applicants respectfully request that the Examiner withdraw the rejections of claims 3, 11, 14 and 24 under 35 U.S.C. 103(a) and that claims 3, 11, 14 and 24 are in condition for allowance.

For the foregoing reasons, the present application is believed to be in condition for allowance. The Examiner's early and favorable action is respectfully requested. The Examiner is invited to contact the undersigned if he has any questions or comments in this matter.

Respectfully submitted,



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